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NASA TECHNICAL MEMORANDUM NASA TM-75019

EXPERIMENTAL PROGRAM FOR THE OPERATIONAL STUDY OF DATA COLLECTION PLATFORMS IN BOLIVIA

BOLIVIAN GEOLOGICAL SURVEY
NATURAL RESOURCES TECHNOLOGICAL SATELLITE PROGRAM

Translation of "Programa Experimental para el Estudio Operacional de Plataformas de Recolección de Datos en Bolivia," Programa ERTS - Bolivia, Servicio Geologica de Bolivia, La Paz, Bolivia, Report, December 1975, pp. 1-10z

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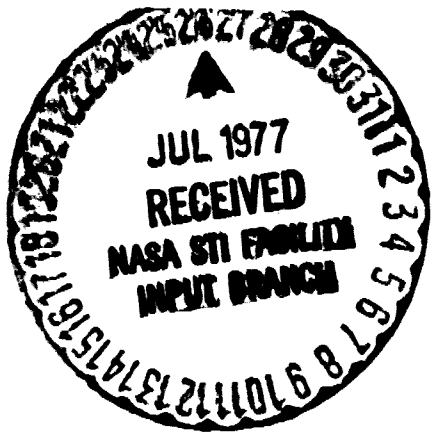

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546 JUNE 1977

receiving station in view of the fact that the distances from the Goddard station to Bolivia and to Iceland are approximately equal and that the Iceland-Goddard tests had met with success.

In order to conduct the test, the U.S. Geological Survey sent the GE ID 6331 platform together with a limnographer. Simulation testing was begun on January 30 at 1400 hours Greenwich Mean Time at a position whose coordinates were 68° 31' west longitude and 16° 30' south latitude and at an altitude of 4,150 meters above sea level.

Due to the fact that none of the signals transmitted was received at any U.S.A. receiving station, the transmitter was examined. As a result, the printed circuit on card A-3 was found to be defective (possibly due to damage occurring during transportation).

Because of the abovementioned difficulty, the U.S. Geological Survey shipped ID platform number 6312 to the Bolivian Geological Service. After tests had proved that the equipment functioned perfectly, it was /2 installed at 67° 54' 30" west longitude and 17° 15' 12" south latitude and at an altitude of 3,740 meters above sea level, with unlimited visibility for all values of azimuth. Transmission was initiated on July 2, 1975 at 1800 hours GMT.

This time, the signals transmitted by the platform equipment were not received by the ground station of NASA's Goddard Space Center in the U.S.A.

Later on, additional tests were conducted in coordination with the satellite tracking station installed by NASA at Colina, Chile. These experiments were successful since the signals were received on Septem-

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15. Supplementary Notes

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16. Abstract

One of the objectives of this experiment is to evaluate the system developed for the SMS/GOES satellite while learning the limitations possessed by this system with regard to the LANDSAT 1 and 2 satellites with respect to the transmission distance and horizon angle.

Another objective of this project is to evaluate the advantages possessed by this system in comparison with conventional methods so as to permit studying the feasibility of introducing it into this country in the near future.

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BOLIVIAN GEOLOGICAL SURVEY

NATURAL RESOURCES TECHNOLOGICAL SATELLITE PROGRAM

EXPERIMENTAL PROGRAM FOR THE OPERATIONAL STUDY OF DATA COLLECTION PLATFORMS IN BOLIVIA

ERTS program for Bolivia

BOLIVIAN GEOLOGICAL SERVICE

December 1975

1. BACKGROUND /1

The Bolivian ERTS Program Administration signed a research agreement with the United States Geological Service in January 1975 for the purpose of performing research relating to the employment of a data collection platform utilizing the ERTS-1 satellite.

This agreement was reached for the purpose of studying the possibility of receiving signals emanating from Bolivia at NASA's Goddard

ber 30, 1975.

This experiment proved that the ID 6312 platform was operating perfectly, this fact having been previously indicated by means of the Field Test Set. At the same time, it was shown that NASA's Colina Station is now capable of receiving signals although it does not possess a coding capability due to lack of the necessary equipment required for this purpose.

2.0. INTRODUCTION

Extensive use of the data gathering platforms has been made in the U.S.A. where geological, hydrological and environmental experiments were conducted as well as in Central America and in Iceland where experimentation was restricted to the areas of geology and hydrology.

Therefore, because of the information supplied by Mr. Herbert Schumann during November 1974, interest was expressed by the National Electrification Administration, an organization responsible for hydrological resources for the generation of power, as well as by the National Meteorological and Hydrographic Service of the Ministry of Transportation and Communication. /3

Consequently, the National Meteorological and Hydrological Service has prepared a tentative program for installing a DORSETT platform which is compatible with the LANDSAT and GOES satellites, the same one that will be employed for the GE ID 6312 platform that will operate with the LANDSAT -1 and LANDSAT-2 satellites together with the NASA station at Colina, Chile.

3.0. OBJECTIVES

One of the objectives of this experiment is to evaluate the system developed for the SMS/GOES satellite while learning the limitations possessed by this system with regard to the LANDSAT 1 and 2 satellites with respect to the transmission distance and horizon angle.

Another objective of this project is to evaluate the advantages possessed by this system in comparison with conventional methods so as to permit studying the feasibility of introducing it into this country in the near future.

4.0. EQUIPMENT

4.1. Types of platforms

4.1.1. Data Collection Platform

4.1.1.1. GE ID 6312 Platform

Within the scope of the experimental program proposed, it has been suggested that the GE ID 6312 platform be used to take simulation measurements at the various locations indicated in paragraph 5.0 /4 so as to evaluate its potential when employed with the NASA station at Colina, Chile.

4.1.1.2. DORSETT Compatible Platform

Due to the inherent characteristics of the DORSETT system, it has been proposed that experiments shall be conducted using the GOES-1 satellite and that, depending on the results obtained, it may replace the LANDSAT system.

4.2. Sensors

In order to facilitate experimentation and in view of the importance

of the parameters to be measured, it was decided to study the possibility of employing sensors to obtain the following information: precipitation; temperature; wind direction and speed; water level; rate of water flow.

The data obtained during this phase shall be evaluated together with those furnished by the conventional weather stations with respect to quality, quantity and frequency.

5.0. LOCATION

Selection of the sites for the data collection platforms has been made by considering the factors of accessibility. topography and location of existing security weather stations as well as the distance from the NASA station at Colina, Chile (see attached map).

5.1. Guanay Station /5

Coordinates: 67° 52' west longitude; 15° 27' south latitude.

Altitude: 545 meters.

The Guanay station is located in the eastern spur of the Central Andes Mountain range, in a deep valley through which flows the Kara River that constitutes the headwaters of the Beni River. Precipitation, ambient temperature, wind direction and speed, level and flow rate of the river will be measured over a period of 30 days.

It is intended to use the ID 6312 platform in order to investigate the line-of-sight limitations with respect to the NASA station at Colina, Chile.

5.2. Canal Guanaqui Station

Coordinates: 68°51' west longitude; 16° 27' south latitude.

Altitude: 3,806 meters.

The Canal Guanaqui Station is located at the source of the Desaguadero River at Lake Titicaca, where the topography is gentle due to the flat nature of the land. As in the preceding case, measurements will be made of precipation, ambient temperature, wind direction and speed, as well as flow rate over a period of one month.

5.3. Chuquina Station /6

Coordinates: 67° 28' west longitude; 17° 46' south latitude.

Altitude: 3,760 meters.

Located over the Desaguadero River, in the Bolivian plateau region where the Desaguadero River frequently floods the area, the land is perfectly flat and variations of temperature of 20°C occur. Duration of experiment is one month.

5.4. Villa Tunari Station

Coordinates: 65° 23' west longitude; 16° 58' south latitude.

Altitude: 292 meters.

This station is located in the Chaco-Beni Plain, adjacent to the spurs of the sub-Andean and Central Andean Mountain Range zone, where the steepest slopes of the country are located. Variations in topography reach a value of 5,000 meters over a distance of 80 kilometers in a straight line southwest of the station. This area is reputed to be the rainiest one in Bolivia and has an average rainfall of 6,000 millime-

ters per year.

This station is located over the Chapare River, which is the source of the Mamore River. This area has been selected to investigate its possible effect on line-of-sight transmission via the LANDSAT satellite to the NASA Station at Colina, Chile. Duration of experiment is one month.

5.5. Presidente Pacheco Station /7

Coordinates: 64° 11' west longitude; 19° 51' south latitude.

Altitude: 1,220 meters.

The Presidente Pacheco station is located over the Azero River, a tributary of the Grande River, at a narrow neck in its course.

This point was chosen since it is representative of the area in order to study the possibility of employing the LANDSAT satellite with this type of terrain. The parameters to be measured are the same as those specified for the previous stations. Duration of experiment is one month.

5.6. Villamontes Station

Coordinates: 63° 29' west longitude: 21° 16' south latitude.

Altitude: 448 meters.

This station is located over the Pilcomayo River which belongs to the La Plata River basin. It lies immediately east of the Aguarague Mountain range, where a topographic variation of 1,200 meters exists.

It is also intended to study its influence on line-of-sight transmission via the LANDSAT satellite to the NASA station at Colina, Chile.

The same parameters as those for the foregoing stations will be measured, using the DORSETT platform. Duration of experiment is one month.

5.7. Yapacani Station 18

Coordinates: 63° 29' west longitude; 17° 24' south latitude.

Altitude: 324 meters.

The Yapacani Station is located above the river bearing its name, where the river enters the Beni plain in a tropical area. This river is quite extensive due to the regular floods occurring in this region. An operational station is being planned in this sector for the purpose of furnishing basic data for use in construction of the Santa Cruz-Trinidad Railroad. The same parameters as those measured for the aforementioned stations will be measured in this case. Duration of the experiment is to be one month.

5.8. Puerto Pailas Station

Coordinates: 62° 48' west longitude, 17° 31' south latitude.

Altitude: 300 meters.

This station is to be located in the vicinity of the Pailas Station of the Santa Cruz-Corumba Railroad over the Grande River (tributary of the Mamore River) in the Chaco-Beni plain. Experiments will last a total of 30 days after installation of the station.

5.9. Loma Suarez Station

Coordinates: 65° 04' west longitude; 14° 55' south latitude.

Altitude: 300 meters.

This station will be located in the Beni plain, in the vicinity

of the city of Trinidad, over the Ibare River. The climate of this zone is tropical. This zone is accessible only by air. The same parameters as in previous cases will be measured here. Duration of experiment is one month. /9

5.10. Riberalta Station

Coordinates: 66° 06' west longitude; 11°03' south latitude.

Altitude: 172 meters.

This is located at the junction of the Beni and Madre de Dios Rivers (tributaries of the Madera River), considered to be the largest rivers in Bolivia and which wander through the tropical Beni plain.

The proposed station is located at a distance of approximately 2,000 kilometers north of the NASA station of Colina, Chile. This location will provide a test of transmission via LANDSAT to NASA-Chile. Access is available by air or river. Duration of the test is scheduled to be 30 days.

5.11. Cobija Station

Coordinates: 68° 44' west longitude; 11° 01' south latitude.

Altitude: 180 meters.

This station is to be located on the Acre River in the vicinity of the city of Cobija. This region has the same topographic and environmental characteristics as the Riberalta Station. Access is available only by air. The tests will run for one month.

6.0. RESULTS EXPECTED /10

Due to the fact that the proposed experimental program is broad in

scope and includes all of the environmental conditions of the Bolivian territory, it is predicted that employment of the compatible platform DORSETT, which uses the satellite GOES, will present no problems with respect to data transmission. However, it is believed that there will be constraints in employment of platform ID 6132, which will use the LANDSAT 1 and 2 satellites, because of orbital factors.

7.0. DATA PROCESSING AND TRANSMISSION TO BOLIVIA

Based on the existing bibliography, the flow of data into the ERTS Bolivia program is difficult to predict due to the lack of presently available information with regard to the GOES satellite system. Nevertheless, it is believed that the final product will be sent by mail in the form of punched cards, magnetic tape and computer printouts.

However, it is necessary to study the possibility of transmitting processed data via telex so as to impress the interested organizations with the speed and efficiency possessed by the system in obtaining data in real time.

KEY TO MAP (front side) /MAP

INSERT AT UPPER RIGHT CORNER: Map of the Republic of Bolivia..... Compiled from official cartographic documents of the Military Geographical Institute.....Printed by authority of President Brigadier General Hugo Banzer Suarez.....Organized, executed and printed at the Military Geographical Institute. Scale of 1 to 4 million..... Signed by Brigadier General Oscar Wilde Fernandez, Commander of the Military Geo-

graphical Institute. (End of insert).

signos convencionales = conventional signs. caminos = roads. transitable todo el ano = passable to traffic all year round. Afirmado solido dos vias = road firm in both directions. revestimiento suelto o ligero dos vias = road surface loose or light, two lanes. Una via = one lane. transitable en tiempo bueno o seco = road passable in fair or dry weather. revestimiento suelto = road surface loose. Vereda = trail. Ferrocarriles = railroads. Via sencilla, trocha normal o ancha = single track, standard or narrow gauge. Limites = boundaries. poblaciones = towns. capital de la Republica = capital of the Repuolic. capital de departamento = departmental capital. 1^{ra} seccion. = first section. 2^{da} = second. 3^{ra} = third. 4^{a} y 5^{a} = fourth and fifth. poblaciones pequenas de importancia = important small towns. rios perennes = permanent (year round) rivers. aeropuerto = airport. puerto = seaport. salitre = saltpeter deposit. pista de aterrizaje = landing runway. ancladero = anchorage. banados = marsh land. ubicacion de estaciones = location of stations.

KEY TO MAP (rear side)

cuadro demostrativo, red vial de Bolivia = drawings of Bolivian transportation routes. caminos = roads. localidad = place. Distancias = distances. kms. = kilometers. parcial = partial. alturas s.n.m. = height above sea level. lineas aereas = airlines. rios navegables del norte de la republica = navigable rivers in northern portion of Republic of Bolivia. puerto fluvial = river port. puerto lacustre = lake port. alojamiento = lodging. (End of key).